

TITLE OF THE INVENTION

PRINTER APPARATUS, CONTROL METHOD AND CONTROL PROGRAM
THEREFOR, AND COMPUTER-READABLE STORAGE MEDIUM CONTAINING
5 THE CONTROL PROGRAM

BACKGROUND OF THE INVENTION

Field of the Invention

10 The present invention relates to a printer apparatus that is linked to an external host unit via a predetermined interface and that prints data received from the host unit on cut-sheet paper, a control method and control program used for the printer apparatus, and a computer-readable storage medium containing the control program.

15

Description of the Related Art

Conventionally, if a cable for the interface with the host unit is disconnected, in other words, the interface link is broken while the above printer apparatus
20 (hereinafter also referred to simply as the "printer") is printing the print data, the printer cannot detect and notify the situation to the user of the printer. In this situation, the printer cannot receive the print data (including control commands) during a printing process, and
25 the printer performs the printing of print data remaining in

a receiving buffer that temporarily stores the received print data. In many cases, in the remaining print data, print data for the last page is not completely printed, and the printer does not receive a paper-discharge command to 5 discharge the last page. Accordingly, in many cases, disconnection of the interface cable during the printing process causes the printer to terminate printing without discharging the sheet of paper on which the print data for the last page is printed.

100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
355
360
365
370
375
380
385
390
395
400
405
410
415
420
425
430
435
440
445
450
455
460
465
470
475
480
485
490
495
500
505
510
515
520
525
530
535
540
545
550
555
560
565
570
575
580
585
590
595
600
605
610
615
620
625
630
635
640
645
650
655
660
665
670
675
680
685
690
695
700
705
710
715
720
725
730
735
740
745
750
755
760
765
770
775
780
785
790
795
800
805
810
815
820
825
830
835
840
845
850
855
860
865
870
875
880
885
890
895
900
905
910
915
920
925
930
935
940
945
950
955
960
965
970
975
980
985
990
995
1000
1005
1010
1015
1020
1025
1030
1035
1040
1045
1050
1055
1060
1065
1070
1075
1080
1085
1090
1095
1100
1105
1110
1115
1120
1125
1130
1135
1140
1145
1150
1155
1160
1165
1170
1175
1180
1185
1190
1195
1200
1205
1210
1215
1220
1225
1230
1235
1240
1245
1250
1255
1260
1265
1270
1275
1280
1285
1290
1295
1300
1305
1310
1315
1320
1325
1330
1335
1340
1345
1350
1355
1360
1365
1370
1375
1380
1385
1390
1395
1400
1405
1410
1415
1420
1425
1430
1435
1440
1445
1450
1455
1460
1465
1470
1475
1480
1485
1490
1495
1500
1505
1510
1515
1520
1525
1530
1535
1540
1545
1550
1555
1560
1565
1570
1575
1580
1585
1590
1595
1600
1605
1610
1615
1620
1625
1630
1635
1640
1645
1650
1655
1660
1665
1670
1675
1680
1685
1690
1695
1700
1705
1710
1715
1720
1725
1730
1735
1740
1745
1750
1755
1760
1765
1770
1775
1780
1785
1790
1795
1800
1805
1810
1815
1820
1825
1830
1835
1840
1845
1850
1855
1860
1865
1870
1875
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
2095
2100
2105
2110
2115
2120
2125
2130
2135
2140
2145
2150
2155
2160
2165
2170
2175
2180
2185
2190
2195
2200
2205
2210
2215
2220
2225
2230
2235
2240
2245
2250
2255
2260
2265
2270
2275
2280
2285
2290
2295
2300
2305
2310
2315
2320
2325
2330
2335
2340
2345
2350
2355
2360
2365
2370
2375
2380
2385
2390
2395
2400
2405
2410
2415
2420
2425
2430
2435
2440
2445
2450
2455
2460
2465
2470
2475
2480
2485
2490
2495
2500
2505
2510
2515
2520
2525
2530
2535
2540
2545
2550
2555
2560
2565
2570
2575
2580
2585
2590
2595
2600
2605
2610
2615
2620
2625
2630
2635
2640
2645
2650
2655
2660
2665
2670
2675
2680
2685
2690
2695
2700
2705
2710
2715
2720
2725
2730
2735
2740
2745
2750
2755
2760
2765
2770
2775
2780
2785
2790
2795
2800
2805
2810
2815
2820
2825
2830
2835
2840
2845
2850
2855
2860
2865
2870
2875
2880
2885
2890
2895
2900
2905
2910
2915
2920
2925
2930
2935
2940
2945
2950
2955
2960
2965
2970
2975
2980
2985
2990
2995
3000
3005
3010
3015
3020
3025
3030
3035
3040
3045
3050
3055
3060
3065
3070
3075
3080
3085
3090
3095
3100
3105
3110
3115
3120
3125
3130
3135
3140
3145
3150
3155
3160
3165
3170
3175
3180
3185
3190
3195
3200
3205
3210
3215
3220
3225
3230
3235
3240
3245
3250
3255
3260
3265
3270
3275
3280
3285
3290
3295
3300
3305
3310
3315
3320
3325
3330
3335
3340
3345
3350
3355
3360
3365
3370
3375
3380
3385
3390
3395
3400
3405
3410
3415
3420
3425
3430
3435
3440
3445
3450
3455
3460
3465
3470
3475
3480
3485
3490
3495
3500
3505
3510
3515
3520
3525
3530
3535
3540
3545
3550
3555
3560
3565
3570
3575
3580
3585
3590
3595
3600
3605
3610
3615
3620
3625
3630
3635
3640
3645
3650
3655
3660
3665
3670
3675
3680
3685
3690
3695
3700
3705
3710
3715
3720
3725
3730
3735
3740
3745
3750
3755
3760
3765
3770
3775
3780
3785
3790
3795
3800
3805
3810
3815
3820
3825
3830
3835
3840
3845
3850
3855
3860
3865
3870
3875
3880
3885
3890
3895
3900
3905
3910
3915
3920
3925
3930
3935
3940
3945
3950
3955
3960
3965
3970
3975
3980
3985
3990
3995
4000
4005
4010
4015
4020
4025
4030
4035
4040
4045
4050
4055
4060
4065
4070
4075
4080
4085
4090
4095
4100
4105
4110
4115
4120
4125
4130
4135
4140
4145
4150
4155
4160
4165
4170
4175
4180
4185
4190
4195
4200
4205
4210
4215
4220
4225
4230
4235
4240
4245
4250
4255
4260
4265
4270
4275
4280
4285
4290
4295
4300
4305
4310
4315
4320
4325
4330
4335
4340
4345
4350
4355
4360
4365
4370
4375
4380
4385
4390
4395
4400
4405
4410
4415
4420
4425
4430
4435
4440
4445
4450
4455
4460
4465
4470
4475
4480
4485
4490
4495
4500
4505
4510
4515
4520
4525
4530
4535
4540
4545
4550
4555
4560
4565
4570
4575
4580
4585
4590
4595
4600
4605
4610
4615
4620
4625
4630
4635
4640
4645
4650
4655
4660
4665
4670
4675
4680
4685
4690
4695
4700
4705
4710
4715
4720
4725
4730
4735
4740
4745
4750
4755
4760
4765
4770
4775
4780
4785
4790
4795
4800
4805
4810
4815
4820
4825
4830
4835
4840
4845
4850
4855
4860
4865
4870
4875
4880
4885
4890
4895
4900
4905
4910
4915
4920
4925
4930
4935
4940
4945
4950
4955
4960
4965
4970
4975
4980
4985
4990
4995
5000
5005
5010
5015
5020
5025
5030
5035
5040
5045
5050
5055
5060
5065
5070
5075
5080
5085
5090
5095
5100
5105
5110
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220
5225
5230
5235
5240
5245
5250
5255
5260
5265
5270
5275
5280
5285
5290
5295
5300
5305
5310
5315
5320
5325
5330
5335
5340
5345
5350
5355
5360
5365
5370
5375
5380
5385
5390
5395
5400
5405
5410
5415
5420
5425
5430
5435
5440
5445
5450
5455
5460
5465
5470
5475
5480
5485
5490
5495
5500
5505
5510
5515
5520
5525
5530
5535
5540
5545
5550
5555
5560
5565
5570
5575
5580
5585
5590
5595
5600
5605
5610
5615
5620
5625
5630
5635
5640
5645
5650
5655
5660
5665
5670
5675
5680
5685
5690
5695
5700
5705
5710
5715
5720
5725
5730
5735
5740
5745
5750
5755
5760
5765
5770
5775
5780
5785
5790
5795
5800
5805
5810
5815
5820
5825
5830
5835
5840
5845
5850
5855
5860
5865
5870
5875
5880
5885
5890
5895
5900
5905
5910
5915
5920
5925
5930
5935
5940
5945
5950
5955
5960
5965
5970
5975
5980
5985
5990
5995
6000
6005
6010
6015
6020
6025
6030
6035
6040
6045
6050
6055
6060
6065
6070
6075
6080
6085
6090
6095
6100
6105
6110
6115
6120
6125
6130
6135
6140
6145
6150
6155
6160
6165
6170
6175
6180
6185
6190
6195
6200
6205
6210
6215
6220
6225
6230
6235
6240
6245
6250
6255
6260
6265
6270
6275
6280
6285
6290
6295
6300
6305
6310
6315
6320
6325
6330
6335
6340
6345
6350
6355
6360
6365
6370
6375
6380
6385
6390
6395
6400
6405
6410
6415
6420
6425
6430
6435
6440
6445
6450
6455
6460
6465
6470
6475
6480
6485
6490
6495
6500
6505
6510
6515
6520
6525
6530
6535
6540
6545
6550
6555
6560
6565
6570
6575
6580
6585
6590
6595
6600
6605
6610
6615
6620
6625
6630
6635
6640
6645
6650
6655
6660
6665
6670
6675
6680
6685
6690
6695
6700
6705
6710
6715
6720
6725
6730
6735
6740
6745
6750
6755
6760
6765
6770
6775
6780
6785
6790
6795
6800
6805
6810
6815
6820
6825
6830
6835
6840
6845
6850
6855
6860
6865
6870
6875
6880
6885
6890
6895
6900
6905
6910
6915
6920
6925
6930
6935
6940
6945
6950
6955
6960
6965
6970
6975
6980
6985
6990
6995
7000
7005
7010
7015
7020
7025
7030
7035
7040
7045
7050
7055
7060
7065
7070
7075
7080
7085
7090
7095
7100
7105
7110
7115
7120
7125
7130
7135
7140
7145
7150
7155
7160
7165
7170
7175
7180
7185
7190
7195
7200
7205
7210
7215
7220
7225
7230
7235
7240
7245
7250
7255
7260
7265
7270
7275
7280
7285
7290
7295
7300
7305
7310
7315
7320
7325
7330
7335
7340
7345
7350
7355
7360
7365
7370
7375
7380
7385
7390
7395
7400
7405
7410
7415
7420
7425
7430
7435
7440
7445
7450
7455
7460
7465
7470
7475
7480
7485
7490
7495
7500
7505
7510
7515
7520
7525
7530
7535
7540
7545
7550
7555
7560
7565
7570
7575
7580
7585
7590
7595
7600
7605
7610
7615
7620
7625
7630
7635
7640
7645
7650
7655
7660
7665
7670
7675
7680
7685
7690
7695
7700
7705
7710
7715
7720
7725
7730
7735
7740
7745
7750
7755
7760
7765
7770
7775
7780
7785
7790
7795
7800
7805
7810
7815
7820
7825
7830
7835
7840
7845
7850
7855
7860
7865
7870
7875
7880
7885
7890
7895
7900
7905
7910
7915
7920
7925
7930
7935
7940
7945
7950
7955
7960
7965
7970
7975
7980
7985
7990
7995
8000
8005
8010
8015
8020
8025
8030
8035
8040
8045
8050
8055
8060
8065
8070
8075
8080
8085
8090
8095
8100
8105
8110
8115
8120
8125
8130
8135
8140
8145
8150
8155
8160
8165
8170
8175
8180
8185
8190
8195
8200
8205
8210
8215
8220
8225
8230
8235
8240
8245
8250
8255
8260
8265
8270
8275
8280
8285
8290
8295
8300
8305
8310
8315
8320
8325
8330
8335
8340
8345
8350
8355
8360
8365
8370
8375
8380
8385
8390
8395
8400
8405
8410
8415
8420
8425
8430
8435
8440
8445
8450
8455
8460
8465
8470
8475
8480
8485
8490
8495
8500
8505
8510
8515
8520
8525
8530
8535
8540
8545
8550
8555
8560
8565
8570
8575
8580
8585
8590
8595
8600
8605
8610
8615
8620
8625
8630
8635
8640
8645
8650
8655
8660
8665
8670
8675
8680
8685
8690
8695
8700
8705
8710
8715
8720
8725
8730
8735
8740
8745
8750
8755
8760
8765
8770
8775
8780
8785
8790
8795
8800
8805
8810
8815
8820
8825
8830
8835
8840
8845
8850
8855
8860
8865
8870
8875
8880
8885
8890
8895
8900
8905
8910
8915
8920
8925
8930
8935
8940
8945
8950
8955
8960
8965
8970
8975
8980
8985
8990
8995
9000
9005
9010
9015
9020
9025
9030
9035
9040
9045
9050
9055
9060
9065
9070
9075
9080
9085
9090
9095
9100
9105
9110
9115
9120
9125
9130
9135
9140
9145
9150
9155
9160
9165
9170
9175
9180
9185
9190
9195
9200
9205
9210
9215
9220
9225
9230
9235
9240
9245
9250
9255
9260
9265
9270
9275
9280
9285
9290
9295
9300
9305
9310
9315
9320
9325
9330
9335
9340
9345
9350
9355
9360
9365
9370
9375
9380
9385
9390
9395
9400
9405
9410
9415
9420
9425
9430
9435
9440
9445
9450
9455
9460
9465
9470
9475
9480
9485
9490
9495
9500
9505
9510
9515
9520
9525
9530
9535
9540
9545
9550
9555
9560
9565
9570
9575
9580
9585

mechanism by switching the interfaces to select one interface.

In the above-described construction, if a cable for the interface is disconnected, while printing print data received from one host unit via one interface, the printing is interrupted as described above, and the sheet of paper on which a portion of the remaining print data for the last page is printed is not discharged. In this state, in a case in which print data is received from another host unit via another interface and is printed, if a normal paper-feeding mode is activated in which paper is fed from a paper-feeding cassette, the automatic discharge of the remaining sheet of paper is initially performed, and the printer can perform printing without any trouble.

Nevertheless, when print data from another host unit is printed while paper is fed manually by the user, initial discharge of the remaining sheet may not be performed depending on the type of printer. In this case, the remaining sheet for the last page must be discharged by operating the operation panel of the printer in advance. Otherwise, the user must extract the remaining sheet in the case of a printer that cannot be instructed to discharge the paper by operating the operation panel of the printer.

If the user starts printing in which paper is fed manually by the user without being aware of the remaining

sheet for the last page, the printing is started from a portion other than the beginning of the remaining sheet, and results in a failure.

SUMMARY OF THE INVENTION

5

Accordingly, it is an object of the present invention to provide a printer which prevents the foregoing problems from occurring and in which, even if an interface is disconnected while printing is being performed, the printer terminates printing and discharges the paper, such that print data which is received after the disconnection has occurred can be printed. In particular, when the printer detects an error such as the disconnection of the interface, while the printer is printing print data received via one interface, the printer appropriately copes with this situation, and when the printer performs the printing of print data received via another interface with the paper being fed manually by the user, the printer does not require the user to perform initial paper-discharge operations or to extract a remaining sheet of paper as in a conventional type of printer. The printer also performs printing without fail.

To this end, according to an aspect of the present invention, the foregoing object is achieved through provision of a printer apparatus including a detection unit for detecting an interface-disconnection state, and a

10
15

20

25

control unit for performing control processing in which, when the detection unit detects the interface-disconnection state during a printing process, the printing is terminated and paper is discharged.

5 According to another aspect of the present invention, the foregoing object is achieved through provision of a method for controlling a printer apparatus, including a detection step for detecting an interface-disconnection state during a printing process, and a control step for performing control processing in which, when the detection step detects the interface-disconnection state during the printing process, the printing is terminated and paper is discharged.

10
15

20

According to another aspect of the present invention, the foregoing object is achieved through provision of a control program readable by a computer provided in a printer apparatus. The control program includes a detection step for detecting an interface-disconnection state during a printing process, and a control step for performing control processing in which, when the detection step detects the interface-disconnection state during the printing process, the printing is terminated and paper is discharged.

25 According to another aspect of the present invention, the foregoing object is achieved through provision of a

computer provided in a printer apparatus. The control program includes a detection step for detecting an interface-disconnection state, and a control step for performing control processing in which, when the detection 5 step detects the interface-disconnection state during a printing process, the printing is terminated and paper is discharged.

According to another aspect of the present invention, the foregoing object is achieved through provision of a printer apparatus including a plurality of interfaces by which the printer apparatus is linked to a plurality of host units and which are selectively used so that print data is received from one of the host units and is printed on cut-sheet paper by a single printing mechanism, a detection unit for detecting an error state in the selected interface, and a control unit for performing control processing in which, when the detection unit detects the error state in the selected interface during the printing process, the printing is terminated and the printed paper is discharged.

According to another aspect of the present invention, the foregoing object is achieved through provision of a method for controlling a printer apparatus including a plurality of interfaces by which the printer apparatus is linked to a plurality of host units and which are selectively used so that print data is received from one of

the host units and is printed on cut-sheet paper by a single printing mechanism. The method includes a detection step for detecting an error state of the selected interface during a printing process, and a control step for performing control processing in which, when the detection step detects the interface-error state during the printing process, the printing is terminated and paper is discharged.

According to another aspect of the present invention, the foregoing object is achieved through provision of a computer-readable storage medium containing a program for controlling a printer apparatus including a plurality of interfaces by which the printer apparatus is linked to a plurality of host units and which are selectively used so that print data is received from one of the host units and is printed on cut-sheet paper by a single printing mechanism. The program includes a detection step for detecting an error state of the selected interface during a printing process, and a control step for performing control processing in which, when the detection step detects the interface-error state during the printing process, the printing is terminated and paper is discharged.

According to another aspect of the present invention, the foregoing object is achieved through provision of a control program readable by a computer provided in a printer apparatus including a plurality of interfaces by which the

10
15
20

25

printer apparatus is linked to a plurality of host units and which are selectively used so that print data is received from one of the host units and is printed on cut-sheet paper by a single printing mechanism. The control program includes a detection step for detecting an error state of the selected interface during a printing process, and a control step for performing control processing in which, when the detection step detects the interface-error state during the printing process, the printing is terminated and paper is discharged.

Further objects, features and advantages of the present invention will become apparent from the following description of the preferred embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a functional block diagram showing a printer apparatus according to an embodiment of the present invention;

Fig. 2 is a flowchart showing a process that controls the printer apparatus shown in Fig. 1 and that includes a process performed when an interface cable is disconnected while the printer apparatus is printing;

Fig. 3 is a detailed flowchart showing the step S202

shown in Fig. 2 which is performed when the interface cable is for packet communication; and

5 Fig. 4 is a flowchart showing a process that controls the printer apparatus shown in Fig. 1 and that includes a process performed when an interface cable is disconnected while the printer apparatus is printing

DESCRIPTION OF THE PREFERRED EMBODIMENTS

10 An embodiment of the present invention is described below with reference to the accompanying drawings.

15 Fig. 1 is a functional block diagram of a control system in a printer according to an embodiment of the present invention.

16 Fig. 1 shows host units A (100) and B (103) (simply indicated by "HOST A" and "HOST B" in Fig. 1), and a printer 116 according to an embodiment of the present invention. In this embodiment, the printer 116 is an ink-jet printer.

20 The printer 116 is linked to the host units A and B via interfaces A (101) and B (104). Each of the interfaces A (101) and B (104) is, for example, a Centronics interface, a USB (universal serial bus) interface, an IEEE 1394 interface for packet communication or another type of network interface, or a wireless interface using radio waves or 25 infrared radiation, such as a Bluetooth or IrDA (Infrared

Data Association) interface.

The control system in the printer 116 has the following structure.

An interface-A controller 102 and an interface-B controller 5 105 respectively communicate with the host units A (100) and B (103) by performing processing based the protocols of the interfaces A (101) and B (104).

In order that the interfaces A (101) and B (104) may be switched for selectively using either of them, an interface switching controller 106 switches the interface-A controller 102 and the interface-B controller 105 and links either of them to a command analyzer/controller 107 and a printer-status notification unit 115 at the subsequent stage.

The command analyzer/controller 107 analyzes a control command in print data received from the host unit A (100) or B (103) via the interface A (101) or B (104) that is selected by the interface switching controller 106, and converts the control command into an engine-control command for controlling a printer engine 117 (printing mechanism unit) to perform operations in accordance with the control command. The engine-control command is output to an engine controller 108 in the printer engine 117.

The command analyzer/controller 107 is specifically formed by a central processing unit. The command analyzer/controller 25 107 analyzes the control command in

accordance with a control program stored in the random access memory (RAM) of a storage unit 118, and controls the printer 116 in accordance with the result of the analysis. The controlling includes control processes indicated by the flowcharts shown in Figs. 2 and 3, which will be described later. The RAM of the storage unit 118 corresponds to a computer-readable storage medium containing a control program for the printer 116, in which the storage medium and the control program are in accordance with embodiments of the present invention.

The command analyzer/controller 107 uses the RAM of the storage unit 118 as a work area for performing various information processes such as command analysis. Part of the RAM is used as a receiving buffer for temporarily storing print data received from the host unit A (100) or B (103).

The engine controller 108 receives the engine-control command from the command analyzer/controller 107, and performs paper-supply, printing, or paper-discharging operations by controlling an ink-discharge-head control unit 109, a head-position control unit 110, a paper-supply control unit 111, a paper-feed control unit 112, and a paper-discharge control unit 113.

In response to an instruction from the engine controller 108, the ink-discharge-head control unit 109 controls a bubble-jet head (not shown) as a recording head

to discharge ink by supplying power to the heater of the bubble-jet head.

The head-position control unit 110 controls the position of the bubble-jet head by using a pulse motor or 5 the like to move a carriage on which the bubble-jet head is mounted.

The paper-supply control unit 111 controls the driving of a motor as a paper-supply-mechanism driver, whereby cut-sheet paper is supplied from a paper-supply cassette (not 10 shown) mounted on the printer 116 or a manual paper-supply portion (not shown) of the printer 116.

The paper-feed control unit 112 controls the driving of a motor as the driver of a paper-feeding mechanism for feeding a supplied sheet of paper in the printer 116, whereby the supplied sheet is fed. 15

The paper-discharge control unit 113 performs paper discharging by controlling the driving of a motor as the driver of a paper-discharge mechanism for discharging a printed sheet from the printer 116.

20 A printer-status manager 114 posts, to both the command analyzer/controller 107 and a printer-status notification unit 115, the status of the printer 116 which is posted from the engine controller 108.

25 The printer-status notification unit 115 posts the status of the printer 116 to the host unit A (100) or B

(103) via the interface switching controller 106.

Next, with reference to the flowchart of Fig. 2, a control process by the command analyzer/controller 107 and which is described below. The control process includes a process for coping with a case in which an interface cable is disconnected (interface link is broken) while print data being received from the host unit A (100) or B (103) via the interface A (101) or B (104) is being printed in the construction in Fig. 1.

Upon receiving print data from the host unit A (100) or B (103) via the interface A (101) or B (104), the command analyzer/controller 107 initiates the process in Fig. 2. In step S200, when detecting a paper-supply command from the received print data, the command analyzer/controller 107 transmits a paper-supply command to the engine controller 108 instructing it to perform paper-supply operations.

In step S201, the command analyzer/controller 107 determines whether a paper-supply error has been posted from the printer engine 117 via the printer-status manager 114. If a paper-supply error has been posted, the command analyzer/controller 107 proceeds to step S208, and instructs a display unit on an operation panel (not shown) of the printer 116 to display a notification informing the user of a paper-end status. After that, the command analyzer/controller 107 goes back to step S200, and

instructs the engine controller 108 to perform paper-supply operations.

In step S201, after the command analyzer/controller 107 has determined whether or not the paper-supply error has posted, the command analyzer/controller 107 proceeds to step S202, and detects about whether or not the cable of either the interface A (101) or B (104), which is being used, is disconnected (whether link by the interface is broken). A specific method for the determination will be described later.

If the cable is not disconnected, the command analyzer/controller 107 proceeds to step S203, and instructs the engine controller 108 to perform printing of print data on paper.

In step S204, the command analyzer/controller 107 determines whether printing has terminated in accordance with a printing-job-terminating command. If the command analyzer/controller 107 has determined that the printing is not terminated, the command analyzer/controller 107 proceeds to step S205.

In step S205, the command analyzer/controller 107 determines whether paper must be fed to form a new page. If the command analyzer/controller 107 has determined that paper must be fed to form a new page, the command analyzer/controller 107 instructs the engine controller 108

to discharge the printed sheet in step S206, and subsequently goes back to step S200 for supplying paper again. After that, the command analyzer/controller 107 repeats step S201 and the subsequent steps.

5 In step S205, if the determination result is negative, the command analyzer/controller 107 goes back to step S202, and repeats step S202 and the subsequent steps.

10 In step S204, if the command analyzer/controller 107 has determined that printing has terminated, the command analyzer/controller 107 instructs the engine controller 108 to discharge the printed sheet in step S207, and terminates the process.

15 In step S202, if disconnection of the interface cable which is being used is detected, the command analyzer/controller 107 jumps to step S207, and the printed sheet is discharged with the printing immediately terminated in order to complete the process. At this time, any print data remaining in the receiving buffer of the storage unit 118 is erased.

20 However, step S207 may be modified so that, after printing all print data remaining in the receiving buffer, the printing is terminated and the printed sheet is discharged.

25 According to the above-described control process, when one interface is disconnected in process of printing print

data received via the interface, printing of print data received via the interface is terminated and the printed sheet is discharged. This prevents the printing of print data on a remaining sheet when the print data is received via the other interface. In addition, when recognizing disconnection of one interface, a host unit that corresponds to the interface terminates printing due to time-out, and regards the printing as error processing. When the interface is linked again, the host unit transmits new print data. Also in this case, the print data can be printed on a new sheet of paper since the previous sheet does not remain.

A specific method for detecting the disconnection of the interface cable in step S202 is described below.

When a Centronics interface is used as the interface that is being used, in step S202, it is determined whether no control command has not been received for a predetermined period from the corresponding host unit via the Centronics interface. If no control command has been received, this situation is regarded as a state in which the interface cable is disconnected. If a control command has been received, this situation is regarded as a state in which the interface cable is not disconnected (connection is broken).

When a Universal Serial Bus (USB) interface is used as the interface that is being used, in step S202, it is determined whether the USB interface is suspended, in other

words, whether the positive and negative data signals of the USB interface have been at high level for a period or longer. If the USB interface is suspended, this condition is regarded as a state in which the interface cable is disconnected. If not, such a condition is regarded as a state in which the interface cable is not disconnected.

When a packet-communication interface is used as the interface that is being used, in step S202, a situation in which packets to be received for a predetermined period have not been received for the predetermined period is regarded as a state in which the interface cable is disconnected. The details of the process in step S202 are shown as steps S2021 to S2024 shown in Fig. 3.

Referring to Fig. 3, in step S2021, a timer counter (not shown) that measures time intervals for receiving packets is initialized. In step S2022, it is determined whether packets have been received. If the packets have been received, this condition is regarded as a state in which the interface cable is not disconnected. The process proceeds to step S203 in Fig. 2. In step S2022, if the packets have not been received, the value of the counter is incremented in step S2033, and in step S2024, it is determined whether the counter value exceeds an upper limit corresponding to the predetermined period, in other words, whether the packets have not been received for the

10
15
20
25

predetermined period or longer. If the counter value does not exceed the upper limit, the process goes back to step S2022, and the subsequent steps are repeatedly performed. If the counter value exceeds the upper limit, this condition is regarded as a state in which the interface cable is disconnected, and the process proceeds to step S207.

As described above, in this embodiment, while print data, received from either of the host units A (100) and B (103) via either of the interfaces A (101) and B (104), is being printed, when disconnection of the interface cable is detected, the printing is terminated and the printed paper is discharged. Accordingly, when print data, received from the other host unit via the other interface, is printed in a manual-feeding mode, no paper remains in the in-apparatus paper-feeding path since even the last page at the termination of the printing has already been discharged. Therefore, differently from a conventional case, it is not necessary for the user to perform operations for discharging the remaining paper before manually feeding paper, or to extract the remaining paper. In addition, a possibility is eliminated that printing may fail due to the next printing initiated from part of the remaining paper since the user fails to notice the remaining paper, so that the printing can be performed without fail.

Upon detecting the disconnection of the interface cable

that is being used, the command analyzer/controller 107 performs control processing in which printing is unconditionally terminated and the printed paper is discharged, as described above. However, in accordance with 5 the type of paper for printing, the command analyzer/controller 107 may determine whether to perform control processing on the termination of printing and paper discharging in accordance with the disconnection of the interface cable. For example, in a case in which the type 10 of paper for printing is expensive special paper, if the paper is discharged in the middle of printing, and cannot be used for printing, the paper cost increases. Accordingly, the command analyzer/controller 107 is not allowed to perform the control processing on the termination of 15 printing and paper discharging in accordance with the disconnection of the interface cable. In this case, the printing remains interrupted in accordance with the disconnection of the interface cable, and the printing of print data received via another interface is prohibited, whereby paper is not uselessly consumed since the 20 disconnected interface cable is linked again for restarting printing.

In response to a specified control command received from either host unit, or in response to a specified input 25 from an operation unit (not shown) of the printer 116, the

command analyzer/controller 107 may determine to perform the control processing on the termination of printing and paper discharging in accordance with the disconnection of the interface cable.

5 These can be easily implemented by changing the control program of the command analyzer/controller 107 which is stored in the ROM of the storage unit 118.

10 In the above-described embodiment, the disconnection of the interface cable (interface link) is a type of interface error. Thus, the detection of the disconnection of the interface cable in step S202 (Fig. 2) may be changed to the detection of an interface error. The control process shown in Fig. 2 can be applied to interface errors other than disconnection of an interface link. The interface errors other than disconnection of an interface link include a communication error in which, when the interfaces 101 and 15 104 are wireless interfaces that perform communication using radio waves and infrared radiation, such as Bluetooth and IrDA interfaces, communication cannot be established due to an excessive communication range and the existence of an obstacle. In this case, the error detection in step S202 is performed such that the printer 116 is notified of error when communication error is detected in the wireless interface as either the interface 101 or 104, and the error 20 25 notification controls the command analyzer/controller 107 to

100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000

detect interface error.

Other Embodiments

Fig. 4 is a flowchart of a control process for a case in which, when one interface is used to perform printing, the interface is disconnected, and the other interface is used to perform printing by another user.

A program corresponding to the control process in Fig. 4 is stored in the ROM of the storage unit 118, and is executed by the CPU of the command analyzer/controller 107.

In step S400, the process determines whether print data is stored. If the process has determined that the print data is stored, the process proceeds to step S401. If the process has determined that the print data is not stored, the process goes back to step S400.

In step S401, the process determines whether the print data is termination data. If the process has determined that the print data is termination data, the process ends. If the process has determined that the predetermined is not termination data, the process proceeds to step S402.

In step S402, the process performs printing of the print data for one line, and proceeds to step S403. In step S402, the process determines whether paper is supplied before the printing is performed. If no paper is supplied, paper is supplied.

In step S403, the process determines whether the

interface is disconnected. If the process has determined that the interface is not disconnected, the process goes back to step S400. If the process has determined that the interface is disconnected, the process proceeds to step S404.

5 In step S404, the process interrupts the printing, discharges the paper, and goes back to step S400.

Next, an example of a process for a case in which, when a plurality of users use a plurality of interfaces to perform printing, one interface corresponding to the first user among the users is disconnected. For printing by the first user, in step S400, the process determines whether print data is stored. If the print data is stored, the process proceeds to step S401. In step S401, the process determines whether the print data is termination data. If the print data is termination data, the process proceeds to "YES" in step S401 for termination.

10 In step S401, if the print data is not termination data, the process proceeds to "NO", the process performs the printing of the print data for one line. If the present invention is not employed, step S403 is skipped, so that the process goes back to step S400. At this time, in step S400, 20 if print data other than the termination data is not received and stored, the process proceeds to "NO" for performing step S400 to await print data, so that the process loops in step S400 unless receiving print data.

Thus, in a printer in which the present invention is not employed, incompletely-printed paper remains held in a paper-feeding unit.

When, in this condition, print data is received via another interface by another user, paper feeding is performed in order to print the print data for one line. However, because the remaining paper has remained in a paper-feed path, printing is initiated from part of the remaining paper. Otherwise, when new paper is supplied for new printing, paper jamming occurs which makes it impossible to perform printing.

10
15

15

20

In a case in which the present invention is employed, it is determined whether the interface cable is disconnected in step S403, and if the interface cable is disconnected, in step S404, printing is interrupted and paper is discharged, whereby paper used by the first user is discharged beforehand, and print data from the next user can be printed on new paper in step S402. Otherwise, if paper is fed for printing print data from the next user in step S402, the present invention operates so that paper can be fed without paper jamming because incompletely-printed paper does not remain held in the paper-feeding unit.

25

As is clear from the foregoing description, according to the foregoing embodiments, in a printer apparatus which are linked to a plurality of host units via a plurality of

interfaces and which selectively uses the interfaces to receive print data from one of the host units so that the print data is printed on cut-sheet paper by a single printing mechanism, the printing is terminated when 5 disconnection of the selected interface or another type of error is detected during the printing process, and the paper is discharged. Therefore, when another interface which is not disconnected, or which is free of error other than disconnection, is used to receive print data in order that printing is performed in a mode in paper is manually fed, it is not required, differently from a conventional printer apparatus, for the user to initially perform operations for discharging paper remaining in a paper-feed path of the apparatus before manually feeding paper, or to extract the remaining paper. In addition, according to the present invention, a preferable effect can be obtained in that, if the next printing is initiated from part of the remaining paper, it can be completed without fail.

As described above, according to the present invention, 20 if an interface link is broken during a printing process, by terminating the printing and discharging paper, subsequently received print data can be appropriately printed.

While the present invention has been described with reference to what are presently considered to be the 25 preferred embodiments, it is to be understood that the

invention is not limited to the disclosed embodiments. On the contrary, the invention is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.